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$$= \left(\frac{\pi}{16} - \frac{1}{8} \right) / \frac{\pi}{4} = \frac{1}{2} \left(\frac{1}{2} - \frac{1}{\pi} \right).$$

(II) In this case the *superior* limit of ϕ in the numerator of C_1 is the value of ϕ derived from the equation $\sin \phi \cos^3 \phi = \frac{1}{16}\pi$; and the *inferior* limit of the same variable is zero.

The required chance C_2 can, therefore, be found approximately; but is not of sufficient interest to warrant the labor required to find it.

MISCELLANEOUS.

147. Proposed by F. P. MATZ, Sc. D., Ph. D., Reading, Pa.

If P be a point within the scalene triangle, such that $\angle PAB = \angle PBC = \angle PCA = \phi$, then $\cot \phi = \cot A + \cot B + \cot C$ (1), and $\operatorname{cosec}^2 \phi = \operatorname{cosec}^2 A + \operatorname{cosec}^2 B + \operatorname{cosec}^2 C$ (2).

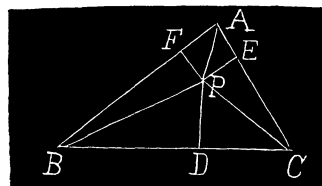
I. Proposed by W. J. GREENSTREET, M. A., Stroud, England.

Let $\angle PAB = \angle PCA = \angle PBC = \phi$. Then $\angle APB = \pi - (\phi + B - \phi) = \pi - B$. Draw PD , PE , PF perpendicular to BC , CA , AB , respectively.

$$PD = PB \sin \phi = \frac{AB \sin PAB}{\sin APB} \cdot \sin \phi = \frac{c \sin^2 \phi}{\sin B}$$

$$= \frac{2Rc}{b} \sin^2 \phi. \quad \text{So } PE = 2R \frac{a}{b} \sin^2 \phi,$$

$$PF = 2R \frac{b}{a} \sin^2 \phi.$$



$$\frac{\sin(A - \phi)}{\sin \phi} = \frac{PE}{PF} = \frac{a^2}{bc} = \frac{\sin A \sin(B + C)}{\sin B \sin C}.$$

$$\therefore \cot \phi - \cot A = \cot B + \cot C, \text{ or } \cot \phi = \Sigma \cot A.$$

$$\text{Also } \cot^2 \phi = \Sigma \cot^2 A + 2 \Sigma \cot B \cot C, \operatorname{cosec}^2 \phi - 1 = \Sigma \operatorname{cosec}^2 A - 3 + 2;$$

$$\text{i. e., } \operatorname{cosec}^2 \phi = \Sigma \operatorname{cosec}^2 A.$$

II. Solution by the PROPOSER.

$$\text{Let } PA = m, PB = n, PC = p. \quad \sin(\pi - B) : \sin(B - \phi) = c : m.$$

$$\therefore \cot \phi - \cot B = (m/c \sin \phi) = 2 \cot B \quad \text{..... (1).}$$

$$\text{Also, } \cot \phi - \cot C = (p/a \sin \phi) = 2 \cot C \quad \text{..... (2);}$$

$$\text{and } \cot \phi - \cot A = (n/b \sin \phi) = 2 \cot A \quad \text{..... (3).}$$

$$\text{Adding, and dividing by (3), we have } \cot \phi = \cot A + \cot B + \cot C \quad \text{..... (A).}$$

Squaring (A), and transforming into cosecants, we have

$$\operatorname{cosec}^2 \phi = \operatorname{cosec}^2 A + \operatorname{cosec}^2 B + \operatorname{cosec}^2 C.$$

Also solved by M. E. Graber, J. Scheffer, and A. H. Holmes.